Local Geography Educator

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Abstract

100-200 words

Contents

1 Introduction

Since recent years there has aroused a new popular way of education, through the mobile platform. Many mobile applications exist with an educational purpose, and some has grown very popular. It turns out the mobile platform is well suited for these purposes. A mobile phone it's easily accessible, it's often with you and it's easy to do a little studying whenever you feel like it and have some time to spare. Moreover, mobile application developers have good potential to make an application stimulating and entertaining using this platform.

The intent of this project is to produce a mobile application capable of teaching local geography to its users. The meaning of local geography in this context is villages, city-districts, roads, parks, rivers, schools and such geographic objects - object inside a limited area, like a city. The goal is to make a stimulating, entertaining and above all educational mobile application. This application will be referred to as *Location Educator* in this document.

Location Educator can for example be useful for someone who wants to gain better knowledge of the city where they live or where they want to go to. People who have a desire to be more knowledgeable about some place in the world. There might also be uses in professional areas. People working with transportation or public communication might benefit greatly. For example taxi and bus drivers. Not mainly to find the way to where they are going, which they likely use a GPS for, but more so for being able to answer questions from the customers about directions and distances.

Several mobile applications for geographic education currently exist. Some examples are Seterra, World Geography, Geo Challenge and MapPie. These are all based on education through quizzes. You are ranked based on the result of a quiz and the goal can be to complete many quizzes with good rankings, get a new high-score or progress to new levels. Such a design enables learning through entertainment and will also be integrated into Location Educator. A defining difference with other applications is this project's focus on local geography, where others usually focus on a global or regional scale, such as continents, oceans, states, provinces and cities.

2 Background

To satisfy the project goal of making a stimulating, entertaining and educational mobile application, careful consideration needs to be taken about the application's design. In this section, relevant areas are investigated and steps towards the design decisions are described. Next section describes the derived design.

2.1 Targeted audience

Good human-computer interaction is a delicate subject. Several aspects need to be considered when designing interfaces, especially when it comes to achieving educational value. Different people think in different ways, have different experiences and and moods. Functionality that feels natural to some might be foreign to others. Human focus is controlled by interest, our memory and patience is limited. There is always a learning curve when exposed to a new system.

To increase the chance of good human-computer interaction, it's appropriate to define a targeted audience. The targeted audience of Location Educator is broad, it's defined as anyone interested in learning local geography. Users might be of different ages with different experiences. Therefor, care is taken to make the interface self-explanatory and very easy to interact with. Simplicity is favored over complex functionality. Focus is on inexperienced users over those preferring more advanced functionality. In order to still accommodate many different users, Location Educator will support different speed in exercise-progression.

2.2 Educational aspects

It's important to keep *human factors* in mind. How do we remember and learn? The human learning process is complex. To learn something new isn't an easy thing, especially not to learn something and remember it for a long time. It's important that the person has an interest and a desire to learn.

A key to learning is associations. The more associations the better. If you hear a name of a town you've never heard of, it's easily forgotten. Then, you see it's location on a map, you here a story about the magnificent mountains there and you meet an inhabitant who turns out to have very red skin, then the name has lot's of associations, and you'll more likely remember it. Finally you realize the name sounds a bit like *red mountains* and you'll never forget it.

The mind forgets and needs to be reminded. Therefore is repetitions important for the learning-process. The longer the knowledge has existed, the less often you need a reminder.

Stimulation is important. A healthy amount of stress will facilitate the learning process greatly. Too little stress and you start thinking of other things. To much and you'll be disturbed and try to escape it.

Finally, it's important to realize that errors and mistakes are okay – it's a part of the learning process. This is something very important to keep in mind when you try to educate someone. At the time of a mistake, don't say "Wrong -next question!". Instead, take this opportunity to make it it right, explain why it's wrong and let the person try again, perhaps this time with a clue.

2.3 Initial potential user considerations

An interview with a potential user was performed before any major design decisions were made. The person was shown some initial sketches of a design. Through discussion, it became clear that a light workload for the user is of importance. Initially, the plan was to let a user study a particular area for a considerable amount of time and then perform an exam for this area in order to move on to next area and level. After the interview this idea was modified into a design that doesn't involve the risk of users getting stuck in the exercise-progression as easily. The new design was discussed with the potential user who agreed that this was an improvement. The modified design involved lightweight levels with subsequent reminders (discussed later in the report).

2.4 Existing application analysis

There currently exist multiple geography educational applications. They are often based on learning through quizzes. The user answers questions like "Where is Stockholm located?", or "What city is this?" and answers through tapping in a map or picking one from multiple alternative. But the

applications differ greatly in key aspects like how to stimulate motivation and goal. Some of these applications has been studied in detail in order to identified strengths and weaknesses from an educational point of view. The results from this study is described in next section. The focus of this study was the following applications: Seterra, World Geography, Geo Sverige, Geo Challenge, Countries of the world, MapPie and Blank Map Quiz.

Worth pointing out is that these applications all have a focus on global or regional geography, that is education of things like continents, oceans, countries, capitals and important landmarks. Despite this difference in focus with Location Educator, they can offer valuable insights in how to, and not to, design an educational geography application.

Furthermore, the language education application *Duolingo* was studied. This application is very popular, which I believe is mainly because of an effective education design. Duolingo also supports quiz-based education and has provided inspiration and ideas.

2.5 Key-functionality for education

Through the existing application analysis and other considerations, some key-functionality-aspects regarding educational value in a quiz-based educational application has been suggested. These aspects are described in the subsections below, along with how they are handled in applications in the existing application study. Opinions about how successful these applications have been in these areas was used as foundation for design decision of Location Educator.

2.5.1 Motivation

Why do you want to continue using the application? Probably because you want to learn geography, but there is need of a specific motivator that shows you that you are making progress and drives you to keep going. One way to implement this is a hunt for high-score – you complete a quiz and get a score, then retakes the quiz to improve the score. The motivator is to achieve good scores on lot's of quizzes. Another motivator is level progression – unlock difficulty by getting good results in exercises currently unlocked, and try to unlock everything (at which point you are a master in this area). Some of the studied applications use a high-score system, some use level progression and some use both.

An example of an application that is high-score based is *Seterra,* where lot's of quizzes are predefined (that is, the content of the quiz doesn't change next time you take it). The user can freely select interesting quizzes and tries to get a good high-score on those. This gives the user great freedom to select what to learn, and it's a powerful educational strategy to retake quizzes and improve the score. It's a comfort for the user to be able to come back to the same quiz that has been taken before. A downside might be that it may seem daunting to select a quiz from the big selection. And also, there is a lack of overall progression which otherwise could provide the user with the sense of going somewhere. The great freedom is good in many ways but also means the user must be disciplined in selecting relevant quizzes and retake them before they are forgotten.

An example of an application that uses level progression is *World Geography*. Here, a quiz is automatically and semi-randomly generated (from some specifications from the user) and by completing a quiz you gain points that eventually takes you to next level. A new level means an

increase in difficulty and more options for quiz-specification. This system is good for motivation since there is a global progression (reaching new levels), and it opens up for a guided increase in difficulty.

2.5.2 Question design

The difficulty of a question should ideally be related to the user's knowledge so that it becomes challenging to answer but not too difficult or easy. If a user only has a slight idea of a subject, it's very rewarding with easy questions that capture this little knowledge and strengthens it.

Question asking and answering should be swift and simple. Questions may vary in difficulty, and it's important for initial questions to be easy to answer. It's a good idea to (to some extent) guide the user to the correct answer so the user leaves the question feeling strengthened and not confused.

Multiple choice questions are good in this regard. "What is the name of the road?", a map with a highlighted road is presented along with some answer alternatives, where the user picks one. Answering is swift and simple, and the user is gently guided to the correct answer since there is a limited number of of alternatives to pick from. The user might also be exposed to names of other geographic objects which never is a bad thing. This is a very popular question type in the studied applications.

Answer through typing is not nearly as common, but exists in for example in the application *Geo Sverige*. It's often more difficult than multiple choice and often quite tedious.

Another question type is *pin-on-map*-questions where the user answers by tapping somewhere in a map. Two types exist of this, either tapping a blank map, or tapping a map with predefined answer points or areas. Tapping a blank map means the user will have to tap close enough to the exact answer. *Geo Challenge* is an example of an application using this. A problem is that the user will never be able to tap exactly correctly so I believe such questions will have a tendency to leave users feeling unsatisfied. Tapping predefined points or areas may be preferable, which also have the potential to guide the user in correct direction because of the limited number of answer alternatives. *Seterra* is an application which relies solely on this type of question.

As mentioned in the Educational aspects section, it's important with multiple associations to support the memory. Therefor it may be important with different types of questions, to attack a subject from different angles. One of the studied applications, *Countries of the world*, utilized this fact beautifully by presenting questions not solely through text or map. In addition, they include flags and capitals into questions.

2.5.3 Educational support

What should happen when the user answers a question incorrectly? This is a very important aspect when it comes to educational value, as mentioned in the Educational aspects section. An incorrect answer is a great opportunity to offer educational support.

Some of the studied applications offers no support, instead moving on to next question, leaving the user feeling confused. Most commonly, applications give the user multiple attempts with a question. The number of attempts varies, often three, sometimes more. Often, I would prefer less number of attempts. If the first or second answer is wrong it's likely that I don't know the answer. Then I

would prefer to be given the answer and move on instead of keep guessing. *Seterra* gives the user three attempt, then reveals the answer and waits for the user to click the correct answer. I find it pleasant to always leave a question after clicking the correct answer, even if it was revealed.

It's common to repeat incorrect questions after the quiz; giving the user another chance, which for example is the case in *World Geography* and *Duolingo*.

2.5.4 Stimulation

As described in Educational aspects section, stimulation is often a good thing during education. In the studied applications, different ways of implementing stimulation exists. Two main categories in this area exists; a clock ticking down, and a clock ticking up.

In application *Geo Challenge*, a quiz is assigned some time and the clock is ticking down. The more questions you answer before time runs out, the better score. This provides lot's of stress, way too much according to me. *World Geography* also has a clock ticking down but it is reset after each question, and the given time is generous. This becomes a mild stimulation which provides a good amount of stress.

A clock ticking up is also common. *Seterra* uses this for example. The time of completing a quiz is recorded along with the score, and the goal is to minimize time and maximize score. Through this method, the amount of stress provided though the stimulator is very much dependent on the user. If the user decides to ignore the time, it offers no stimulation at all. Or the user could hunt for new time-records making the stimulator become very stong.

Also, some applications don't use a stimulator at all, for example *Duolingo*.

2.5.5 Visual appearance

The final suggested key-functionality for education is simply the visual appearance of the quiz. Things like beautiful and contrasting colors, non-cluttered screens and well-thought screen-compositions are very important aspects. Failure here could easily ruin an otherwise good application. This is in some sense the case with the application *MapPie*, where the presented quizzes are very dull in appearance. *Blank Map Quiz* is an example of the opposite. Here, the coloring of the maps presented during quizzes are unsuspected and beautiful.

2.6 Scenario analysis

When making design decisions, it helps to visualize potential users by describing them, their needs and expectations.

- Student in new city, wants to know city better. Busy with school work and activities during daytime but likes to do some light studies of the city before bedtime, for just a couple of minutes. By knowing the city better, the student feels more at home there.

- Older person thinking about moving to Argentina in wintertime. Has found a village that seems pleasant, and likes to study it in detail and dream about the future. Likes the native names of little bakeries and landmarks. Has been guided into learning the application *Duolingo* and through it refresh the language. Is therefor familiar with the concept of

quizzes and progression, even though the person usually finds mobile applications hard to understand.

- A 12-year old who likes to play mobile games and compete with friends. Found Location Educator and likes it since it somehow feels meaningful in a way other games doesn't.

- A taxi-driver who don't like to take up his smart phone every time someone asks him for time estimates and directions. Also, his embarrassed his boss might find out his really not very knowledgeable about the city. So on his vacation, he focuses flat out on the studies.

- A sailor who plans to explore the archipelago of Stockholm. Wants to learn the names of the little islands since it helps with navigation, and helps preserving his memories of the places he passes.

2.7 Functional requirements

Functional requirements were derived, with support from considerations discussed previously. These are requirements of specific behavior of the application.

- User can create an exercise by selecting an arbitrary, size-limited area.

- Maintain a list of exercises.

- Divide geographic objects inside an exercise into categories based on characteristics.

- Divide geographic objects inside an exercise-category into levels based on characteristics.

- Let user take a *level quiz* which takes the user to next level if finished with satisfactory result. The quiz has questions about the geographic objects of this level.

- At certain times, require the user to take a *reminder quiz* – a quiz with questions about geographic objects that has already appeared in a level quiz. These are sometimes required in order to open up a level quiz.

- Integrate *follow-up quizzes*, which follows another quiz with incorrect answers from that quiz.

- Include a stimulator (or stressor) during a quiz, through a clock ticking down which is reset after each question.

- Display a quiz progress-bar, as well as overall exercise-progress.

- Support three different types of quiz-questions; *Name-it*, *Place-it* and *Pair-it*.

- Associate each geographic object with a color based on characteristics. This color is used when the object is presented in quiz questions.

- Integrate *tapping practice*, where a user can practice outside of a quiz.

- Support predefined exercise-areas during exercise creation.

- Exercise-area-sharing and progress-sharing between users.

2.8 Non-functional requirements

Here follows requirements about what the application should *be.*

- The application is required to be educational in local geography. This involves many things; like supporting educational aspects and being graphically and functionally pleasant.

- The application should promote learning about big and important geographic objects first and move to less significant objects later.

- Swift, stimulating, lightweight quizzes with basic design, supporting "*does what you think*".

- Introduce additional associations when asking questions about a geographic object.

- Educational support during a quiz, by guiding user towards correct answer when incorrect answer is given.

- Let user know that he/she is making progress towards a goal.

- Prevent user from forget any previously seen geographic objects. Prefer to remind user of those before introducing new ones.

3 Design

Here follows the intended design of Location Educator through descriptions of the different activities of the application. The images are mock-ups produced using image creating software. This design is the goal of the subsequent implementation.

3.1 Select an exercise

The *select exercise* activity displays a list of existing exercises. The user may click on an exercise to enter it, or create a new one. Exercises are reordered through drag and drop, and deleted through a swipe gesture with following confirmation. Menu button top left has various items: About, Feedback, Logout. The mock-up of this activity is presented in Figure 1.

3.2 Create a new exercise

In this activity, the the user can create a new exercise. The user specifies name and area. The area is arbitrary and drawn using draw-tools of the embedded map. Only smaller areas are allowed (the application is for *local* geography). This restriction is enforced by disabling drawing tools if map is too zoomed out. If this is the case, the map will appear gray and a button appears that, when clicked, animates the zoom of the map to an allowed level. When zoom level is acceptable, drawing is initiated by tapping the map. As soon as the first node is drawn, zooming and scrolling is disabled. The user may clear the drawn path though a button that appears when the first node is placed. Through this design, the size-restriction of the specified area is enforced in a way that is self-explanatory to the user. The mock-up of this activity can be seen in Figure 2.

The functional requirements mentions predefined exercise-areas, which is one way to enable different users to take the same exercise. This may be of interest of users who likes to compare

scores with others. The mock-up doesn't include this feature, as this requirements is put aside initially.

3.3 Inside an exercise

When entering an exercise you're presented with a list of categories, each containing levels, as seen in Figure 3. There are a maximum of five categories, less if the exercise-area doesn't contain any geographic objects of that category. These categories are as follows:

- **Settlements** – geographic objects what may be described as settlements, including cities, towns, villages and neighborhoods. This category also holds things like graveyards, boatyards, and golf courses, basically any kind of named local area that is under human care.

- **Roads** – roads of any sort. Also paths.

- **Nature** – for example forests, nature reserves, islands, beaches, mountains and water bodies of any sort.

- **Transport** – geographic objects related to transportation, for example bus stations, train stations, airports, and ferry terminals.

- **Constructions** – buildings, bridges, tunnels, monuments and so on. Basically anything build by man.

By clicking a category, you are presented with three options: enter a tapping-exercise, attempt a level-quiz or take a category-reminder-quiz. These are described in next sections.

Top right is the overall exercise progression. Down right is a button for taking an exercise-reminder-quiz (as opposed to the more limited category-reminder-quiz). Top left is the menu button which in addition to the items in the menu of the *Select exercise activity* has the option "Select exercise". Also this options menu may contain functionality regarding sharing progress and exercise-area with other users.
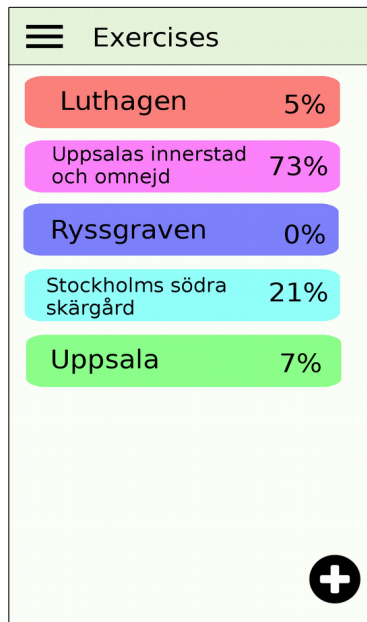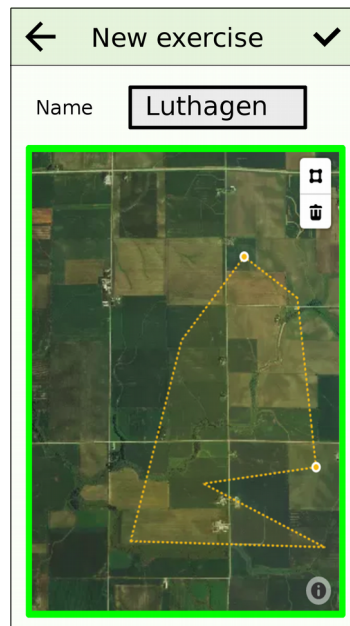
Figure 1: Select exercise activity mock-up.

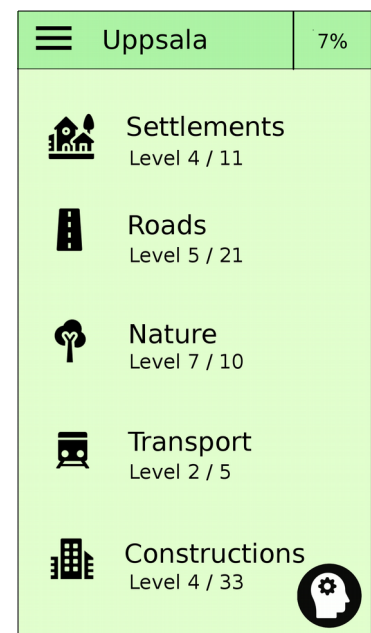*Figure 2: New exercise activity mock-up.*

Figure 3: Mock-up of the activity of an exercise.

3.4 Tapping practice

Tapping practice is useful if a user wants to try his/her knowledge outside of a quiz. It's casual practice which may be enjoyed by some users. The same or similar idea is implemented in the application *Seterra*.

The user is presented with a map containing geographic objects of a certain category in an exercise. The user may freely tap objects in order to display their names for a brief period of time. This is particularly useful when a user wants to attempt to name geographical objects and instantly receive confirmation if the guess was correct. A button above the map let's the user decide if to display geographic objects from next level or from all past levels. See the mock-up in Figure 4.

3.5 Quiz

A quiz handles around five geographic objects, with three to five questions each. There are three different types of questions, *Name-it, Place-it* and *Pair-it* questions, described in detail in next sections. A question must be answered within a certain, generously provided, amount of time and if no answer is given, the correct answer is shown (this is a stimulator). Each object is associated with a color based on its characteristics, which is used when the object is presented in a question, in order to increase the number of association the user has to the object.

There are different types of quizzes:

- Level quiz – for level progression. This quiz has questions about geographic objects of a certain category at a certain level. Increasing levels means less significant objects. The first level may for instance have motorways and the last pathways. Passing a quiz with satisfactory result takes you to next level of this category.

- Reminder quiz – for being reminded of previously seen geographic objects, from previous levels. Problematic and old (long time no see) objects are favored when selecting objects for such a quiz. Reminder quizzes exists both on category-level (for objects in a particular category) and exercise-level (for any seen objects in the exercise). You are required to take a reminder quiz (or a couple) now and then in order to continue level progression, as seen in Figure 5 and 6.

- Follow-up quiz – which follows an other quiz (that isn't follow-up) and repeats the incorrectly answered questions.
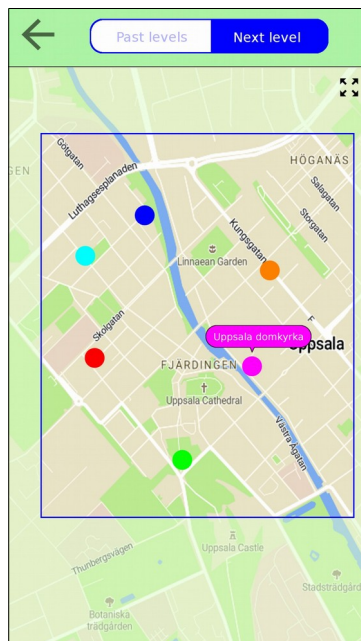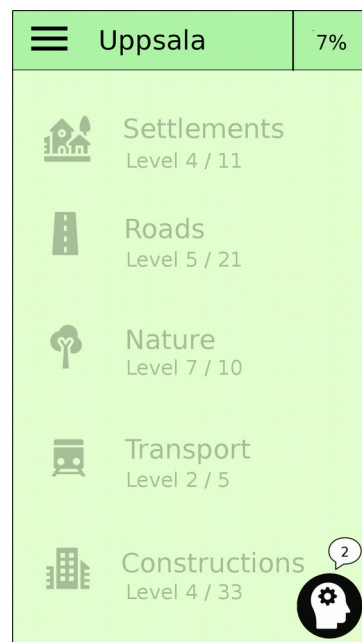

Figure 4: Mock-up of tapping practice.

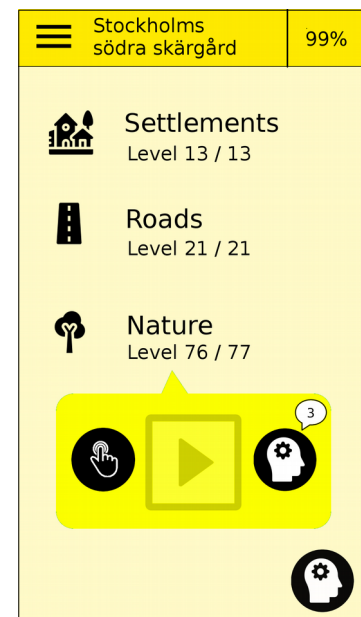*Figure 5: Mock-up of an exercise activity when an exercise-reminder is required.*

Figure 6: Mock-up of an exercise activity when a category-reminder is required.

3.5.1 Quiz question: Name it

A multiple choice question where a geographic object is presented in a map. If correct answer is given, moves on to next questions. If incorrect, another attempt is provided. After that, the answer is revealed and the user chooses the correct alternative before moving on to next question. The number of alternatives is defined by the number of previous questions about this object in the quiz. Initially two alternatives a given, later four and even six. A mock-up is shown in Figure 7.

3.5.2 Quiz question: Place it

In this question you are supposed to tap an object presented in the map after being given a name and a category. An object may be presented as a single marker, a line or a closed line. Similar concepts regarding answering sequence and alternatives count as for Name-it questions. See the mock-up in Figure 8.

3.5.3 Quiz question: Pair it

Here you are supposed to pair name with location, by first tapping a name and then tap the corresponding object in the map. Complete all pairings before the question is done. The objects of this question might not belong to the same level or even category as as the quiz. The only requirement is that the objects have been seen in this or earlier quizzes. Therefor, this question-type has the additional function of reminding the user of previously seen objects. The mock-up is presented in Figure 9.
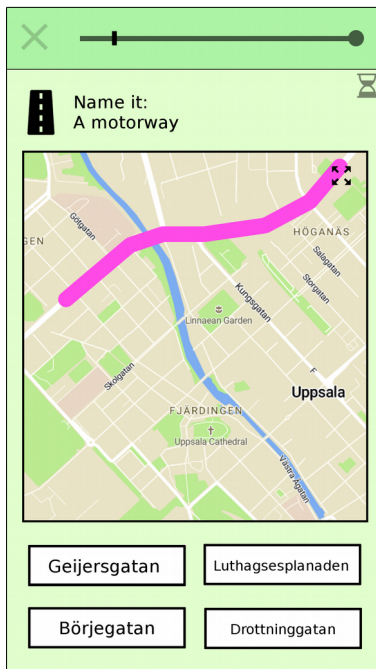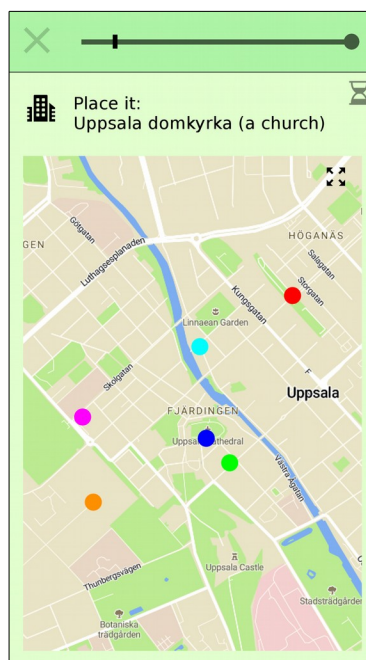

Figure 7: A Name-it question mock-up.

Figure 8: A Place-it question mock-up.

Figure 9: A Pair-it question mock-up.

4 Implementation

4.1 Fetching data

OpenStreetMap, Overpass API

4.2 Processing data

TagInfo, json, regular expressions.

4.3 Integrated maps

MapBox.

4.4 Development tools

Android Studio, Git.

5 Evaluation

Finished product will be tested by some potential users for a validation of the educational value, as a follow-up to the initial user considerations.

6 Future work

User accounts, backing up progress, connecting with friends..

7 Discussion

Do I consider the app to be useful, why, why not? What is good, what is bad?

References

Vancouver style referencing (using brackets [1]). (Mendeley plugin)

[1] Title, writer, publisher, year...